

LORI ICE CLEANER TRIALS

AND

EQUIPMENT EVALUATION

JANUARY 1991

NEWS RELEASE

Lori Ice Cleaner Tested and Delivered

After successful tests on March 26th, 1991 the LIC Lori Ice Cleaner was delivered to the Finnish National Board of Waters and the Environment.

The delivery tests were carried out in the estuary of Uusikaupunki, off the Southwestern coast of Finland. During the tests the LIC was pushed by the 42 m buoy tender "SEILI" in 0.25 m ice and at temperatures of +2...6°C (36...43°F). Level ice was first broken and then 5 barrels of heavy fuel oil were spilled. After some passes at 1.5...2.0 knots the LIC recovered approximately 50% of the oil. A detailed report and a video film of the tests will be prepared by the Technical Research Centre of Finland.

The first part of the LIC delivery tests was carried out 24...30 January, 1991 in Oulu. For the March 26th tests the following changes in the test arrangements were made:

1. Test oil was changed from fresh Soviet Crude of approx. 30 cSt to fresh Heavy Fuel Oil of approx. 5000 cSt (0°C). It was considered that this oil more realistically simulated actual oil recovery conditions in ice.
2. The LIC hydraulic system was fitted with new valves to allow for optimum (slower) speed for the second stage bristles. This resulted in an effective flow of oil into the bristles and in a good oil water separation.
3. The LIC was fitted with two 4.7 ton "tailor made" steel weights secured over the stern of the unit. The weights gave the LIC the proper operation trim and depth.
4. "SEILI" was used as the pushing vessel. This vessel has an open propeller. During the January tests it was observed that the ducted propeller of the "LETTO" sucked in and pulverized large volumes of ice. The pulverized ice then mixed with test oil hampering the LIC oil recovery process.

The above changes and the successful tests in Uusikaupunki resulted in the delivery and owner acceptance of the world's first oil recovery unit for ice conditions.

CONTACT:

ISSUED BY:

X HYDE
Since 1865 **PRODUCTS INC.**

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MEMORANDUM

NOTE DE SERVICE

BMG
CMR
DMG

EMG
FMG

From
De

T. Melhuish
AMGA

Security Classification - Classification de sécurité
Our File - Notre référence
Your File - Votre référence
Date MAY 16 1991

Subject
Objet

ICE CLEANER TRIALS - FINLAND

ESSAIS DU NETTOYEUR POUR
GLACE - FINLANDE

Please find attached John Latour's trip report regarding the Lori Ice Cleaner Trials held in Finland earlier this year.

Vous trouverez ci-joint le rapport de voyage de John Latour au sujet des essais du nettoyeur pour glace qui ont eu lieu en Finlande plus tôt cette année.

As you will note from the material, additional photographs and video tape are available at headquarters. If you have any questions you can contact John at (613) 990-3376.

Comme vous pouvez noter, des photos et un vidéo sont disponibles à l'administration centrale. Si vous avez des questions, n'hésitez pas à contacter John au (613) 990-3376.

T.F. Melhuish

**LORI Demonstration
January 28, 1991**

**LORI Oy Lundin Oil Recovery Inc. Ab.
Karvaamokuja 4
06380 Helsinki
Finland
Phone #: 3580-506-1800
Fax #: 3580-506-2110
Contact: Seppo Korpoo
Lars Lundin Director**

LORI representatives arranged a demonstration of various oil spill countermeasures devices:

- 1) LORI Beach Cleaner**
- 2) LORI Inflatable Boom**
- 3) LORI Side Collector Skimmer**

As noted earlier the LORI skimming system works on a stiff brush system similar to the LARSEN system. The LORI brushes are mounted on a chain rather than a wheel. The brush rotation in this case is up on the forward edge similar to a slicklicker belt. Oil is then combed from the bristles into a sump and pumped to an appropriate storage container.

The group then toured a pollution countermeasure equipment storage depot owned and operated by the Water and Environment Administration in Finland. The attached brochure gives an overview of Administration primary roles.

APPENDIX II
DEMONSTRATION

**LORI Ice Cleaner
January 29, 30, 1991
Oulu Finland**

Due to a lack of ice in the southern portion of Finland the trials were moved from Uusikaupunki to Oulu in the North West side of the Gulf of Bothnia on the West Coast of Finland.

A group of observers were briefed on the trials in a hotel boardroom prior to the vessel departure.

On the first day of trials the vessel LETTO, owned and operated by the Finland Board of Navigation was used to break a rubble field in the entrance of Oulu Harbour. The ice cleaning unit was launched and manoeuvred into position on the bow of the LETTO and made secure.

The Water and Environment Administration of Finland financed the development of the LORI ice skimmer and these tests were organized as acceptance trials for the unit. The equivalent of approximately \$1.2M Canadian has been spent to date building the ice cleaner.

The Administration authorized the use of one barrel of crude oil for the first day of trials and reserved a decision on quantities for the second test pending day 1 results.

The oil used was a 60% water-in-oil emulsion. However, as the oil was spilled on the surface of the ice rubble, it was obvious that the emulsion had been broken. Consequently the quantity of oil spilled was approximately 100 litres in total.

The vessel manoeuvred the ice cleaner into position and advanced over the oiled ice with the units brushes rotating and flushing system providing a water wash over the bow.

Due to the small quantity of oil the results were disappointing. The product mixed with the ice and none was recovered.

The ice cleaner was recovered to the deck of the LETTO and returned to port.

On day two of the trials we were informed that permission had been granted to spill approximately 6 BBL of light Soviet crude oil in the rubble field. This oil was chosen by the Water and Environment Administration of Finland because 80% of the countries imports consist of this product. Representatives from LORI indicated to observers that the oil was much too light for the equipment which was designed to recover a heavier product.

In spite of this conflict the trials continued. Again the cleaner was launched and attached to the bow of the LETOO. The oil, was then spilled and the unit manoeuvred into location to advance over the oil. On this pass the water from the flushing system was directed to the sides of the cleaner rather than over the bow. When the unit passed over the oil, almost immediately product began to flow out of the flushing system on either side of the bow, spreading the oil over a much wider area.

Apparently the product that was delivered by the ice cleaning bristles to the lifting or skimming bristles was so light in viscosity that it was pulled through the lifting bristles into the water pump intake rather than being collected by the bristles and scraped into a collection sump.

Observation/Conclusion

1. Very little oil was recovered.
2. The pumps for the flushing system picked up a large quantity of oil and spread it over a wide area.
3. The lifting bristles picked up ice cube size pieces of ice, some of which were lightly coated with oil.
4. The flushing system picked up oil and spread product over a wider area.
5. The LORI ice cleaner failed to collect a light crude oil from an ice rubble field.
6. The cleaner may have worked better in heavier oil or mousse.

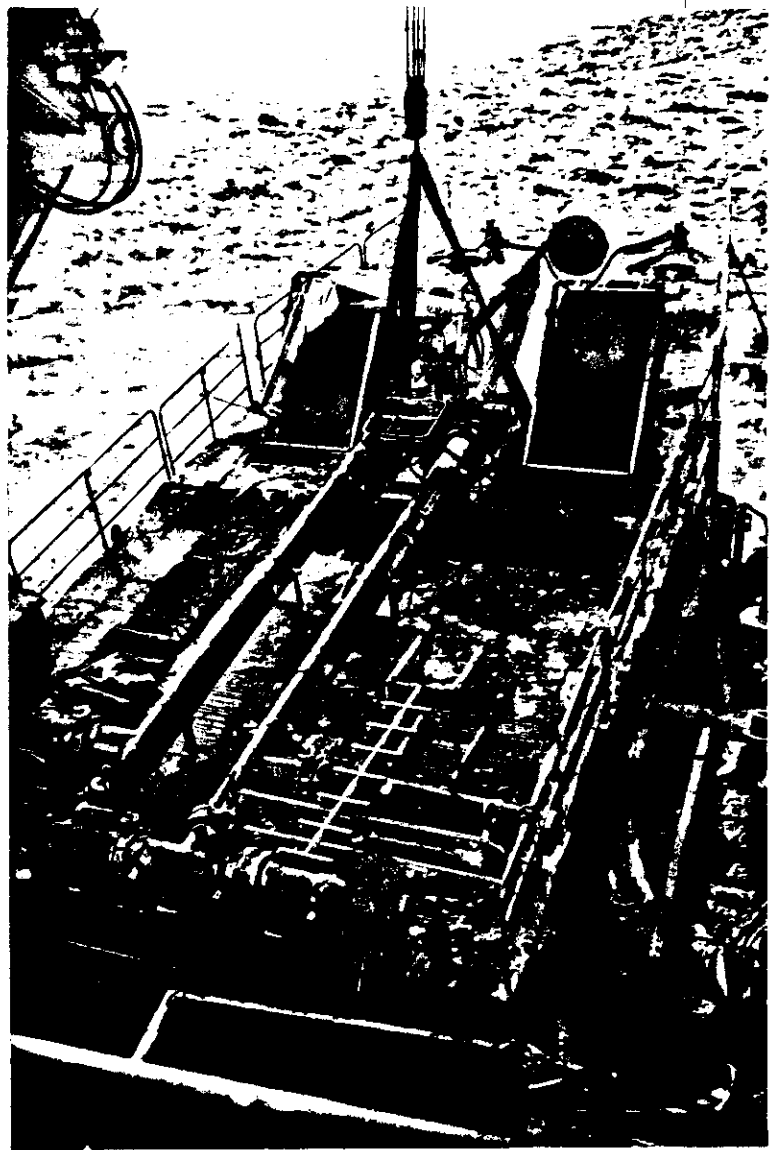
Recommendation

The Canadian Coast Guard must continue to search for new technology that will improve spill cleanup capability. With regard to this particular equipment the Coast Guard should continue to monitor further testing and development to evaluate the usefulness of this type of equipment for the Canadian environment.

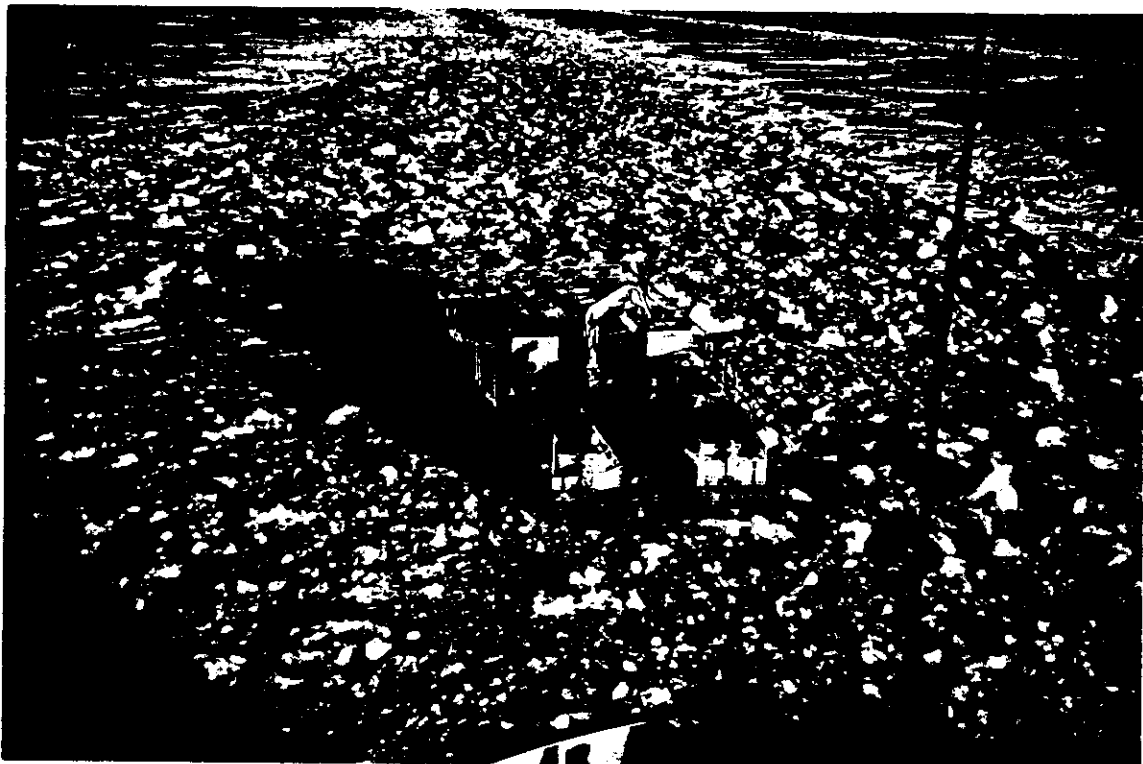
**Day 1 - Ice cleaner trials unit
being prepared for launch.**

NOTE:

- 1) Aft of vessel is at
the top of the photo.
- 2) Flushing manifold.
- 3) Vessel Notch.
- 4) Lifting Bristles.



**Day 1 - Preparing to attach
Ice cleaner to bow of LETTO.**



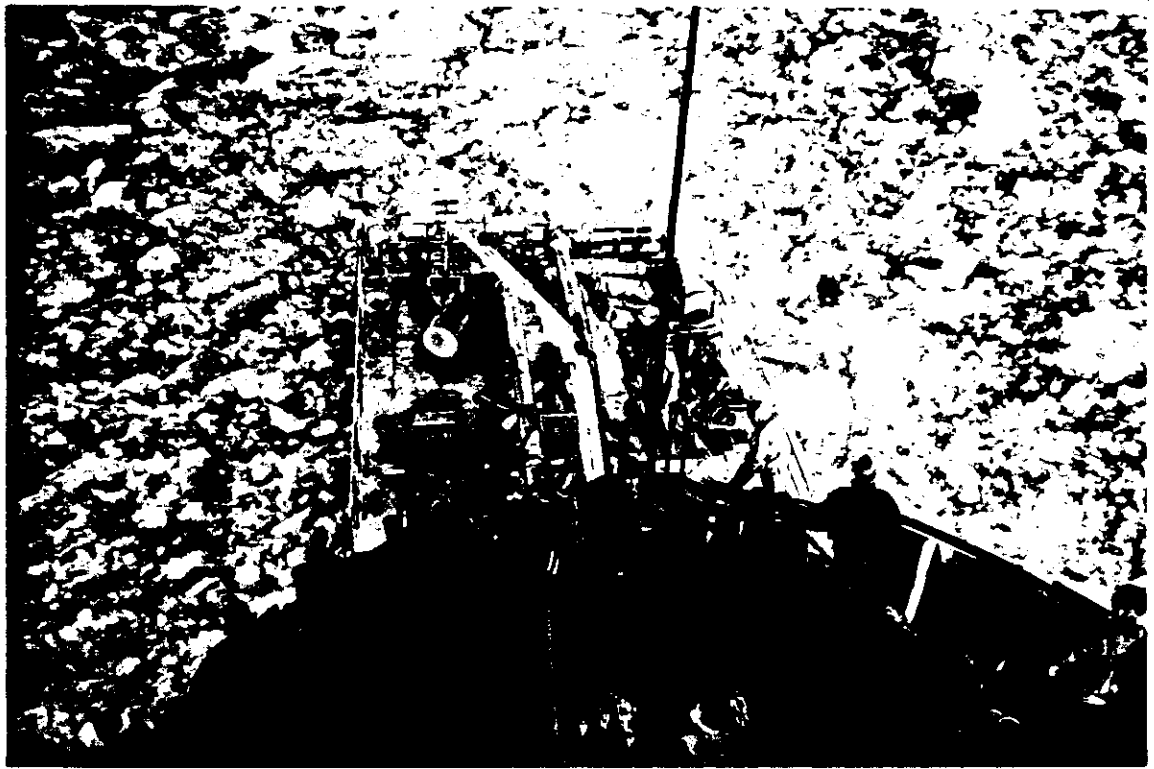


PLATE E

Day 1

**Ice Cleaner attached to bow.
- Preparing to spill oil.**

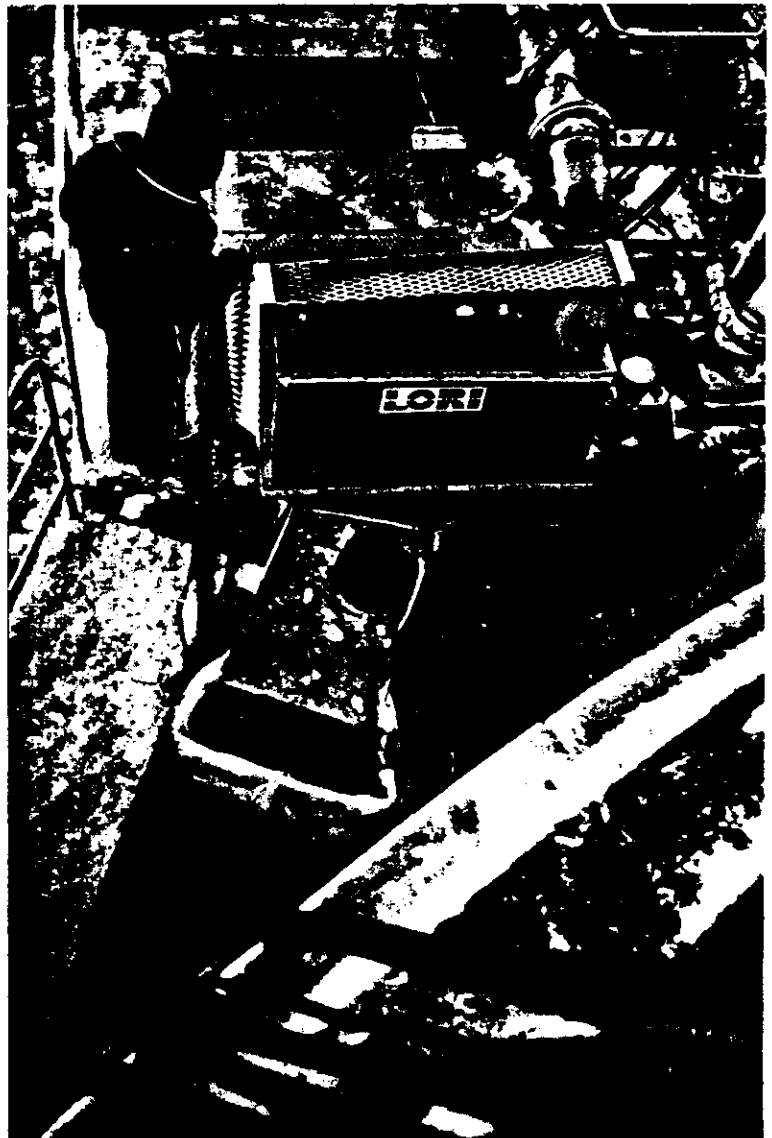


PLATE F

Day 1

**Collection area of LORI
Ice cleaner.**

**NOTE: 1) Lifting Brushes.
2) Discharge shoot and
bagging system.
3) Little oil collection.**

PLATE G

Day 2

**Ice cleaning bristles on
the under side of the vessel.**

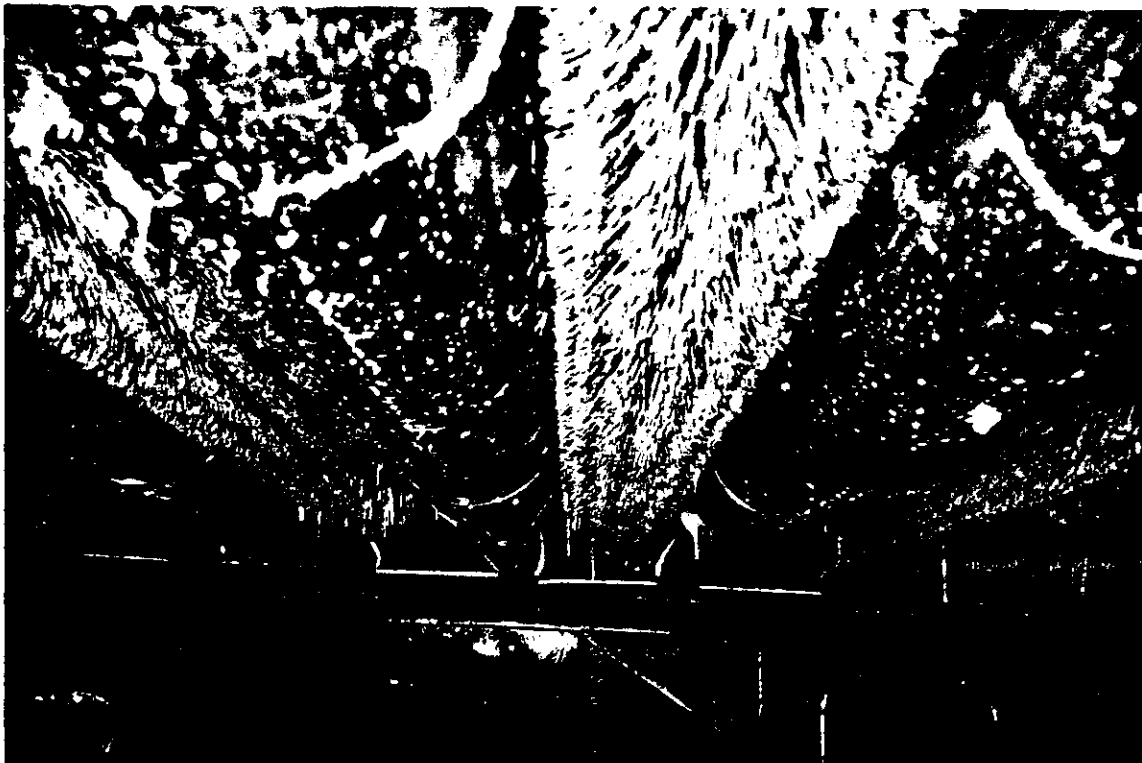


PLATE H

Lifting Oil Skimming bristles.





PLATE I

Day 2

**Spilling 6 barrels of
Russian crude oil in the
ice rubble.**



PLATE J

Day 2

**Discharge shoot showing
oil ice and bagging system.**

LORI Ice Cleaner

Full Scale Tests with Oil

PROGRAM

Time: January 24 - 30, 1991
Place: Gulf of Bothnia, Estuary of the City of Oulu

DAY 1

Thursday, 24/1

FUNCTIONAL TESTING WITHOUT OIL

08 ⁰⁰

Tests in port area

- Coupling / decoupling
- Ballasting / deballasting
- Running of water pumping system
- Running of brush system
- Test of oil receiving station and crane

10 ⁰⁰

Departure from port

11 ⁰⁰

Tests in broken ice fields and in open water

- Transit straight ahead
- Turning right / left
- Backing
- Towing

16 ⁰⁰

Return to port

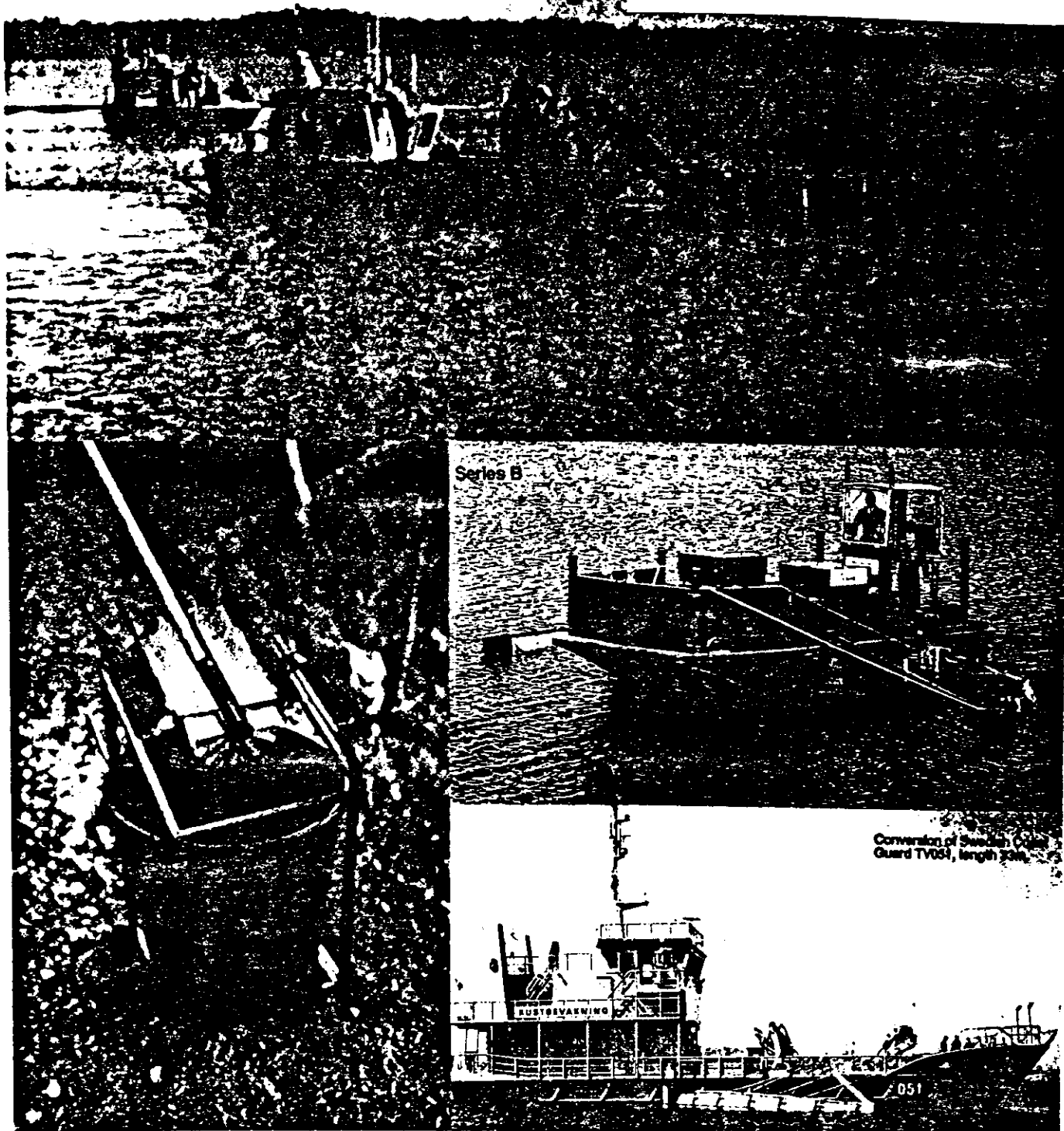
DAY 2	Friday, ²⁵ / ₁	DELIVERY TESTS WITH OIL IN ICE
	07 ⁰⁰	Departure from port
	08 ⁰⁰	Breaking of test ice field
	09 ⁰⁰	Spilling and mixing into ice of Oil № 1
	10 ⁰⁰	Recovery of test oil
	11 ³⁰	Measurement of recovery result, taking of samples
	12 ⁰⁰	Spilling and mixing into ice of Oil № 2
	13 ⁰⁰	Recovery of test oil
	14 ³⁰	Measurement of recovery result, taking of samples
	16 ⁰⁰	Return to port

DAY 3	Tuesday, ²⁹ / ₁	ADDITIONAL TESTS WITH OIL IN ICE
	10 ⁰⁰	Departure from port
		Recovery tests with Oil № 3 & 4
	16 ⁰⁰	Return to port

DAY 4	Wednesday, ³⁰ / ₁	RESERVE DAY
		Repeated / additional tests

LORI

Hyde Products, Inc.
28045 Ranney Parkway
Cleveland, Ohio 44145
216/871-4885



OIL SPILL RESPONSE

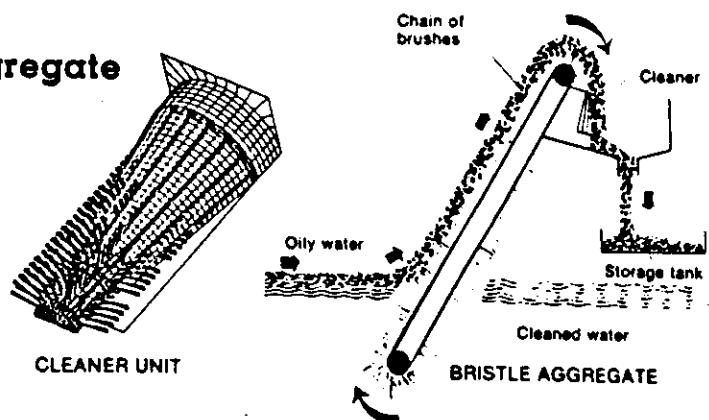
PRODUCT RANGE

LORI OIL SPILL RESPONSE PRODUCT RANGE

LORI offers a range of tested and field-proven systems for effective oil spill response at sea or on inland waterways.

LORI Cleaner Unit and Bristle Aggregate

The LORI product range is based on a patented and proven system which can handle most grades of oil under a wide range of environmental conditions. A special cleaner unit is fitted onto the LORI bristle aggregate, which separates the oil from the water.

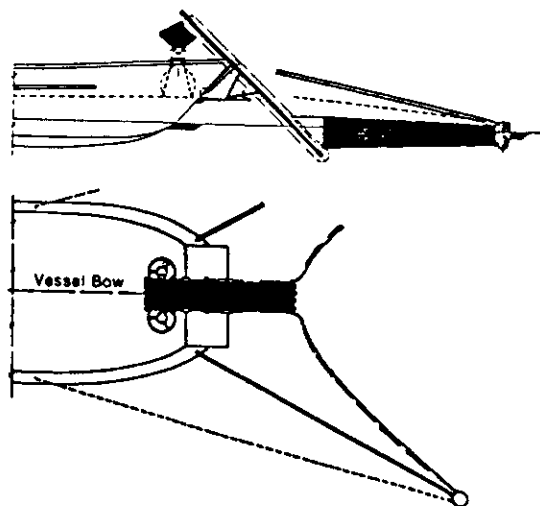


LBC Lori Bow Collector

The LBC, installed on the bow of a boat, is designed to recover oil spilled in relatively sheltered areas, narrow channels, and in shallow water. When not in use the LBC is stowed on a trailer for quick overland transportation to spill sites.

LBC consists of:

- an oil recovery bristle aggregate.
- two oil skimming booms.
- two side jibs with buoys.
- an oil receiving sump with two barrels.
- an hydraulic power unit.

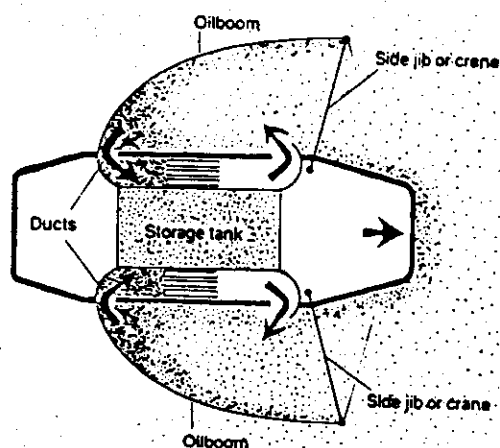


LORS Lori Oil Recovery System

LORS is an oil recovery system designed for ships and large boats. Installed on both sides of a vessel, it can recover various grades of oil at sea. When not in use, LORS is stowed inside the vessel to avoid interfering with other operations.

A typical LORS delivery includes:

- LORS engineering package.
- oil recovery bristle aggregates.
- oil skimming booms.



LBB Lori Beach Broom

The LBB is a beach-cleaning set for manual clean-up of fouled coastal areas. The oil adheres to a specially designed hand broom. It is then removed by pushing the broom through a LORI cleaner unit fitted on top of a portable container.

WATER AND ENVIRONMENT DISTRICTS

	address	telephone
Helsinki	Klaneettitie 6—8 (P.O. Box 58) 00420 Helsinki	90-5664 055
Turku	Itsenäisyydenaukio 2 (P.O. Box 47) 20800 Turku	921-660 111
Tampere	Hämeenkatu 13 A 23 (P.O. Box 297) 33100 Tampere	931-30 511
Kymi	Kauppamiehenkatu 4 (P.O. Box 23) 45100 Kouvola	951-2911
Mikkeli	Raatihuoneenkatu 5 (P.O. Box 77) 50100 Mikkeli	955-1911
Kuopio	Kauppakatu 39 A (P.O. Box 49) 70100 Kuopio	971-164 411
North Karelia	Torikatu 36 A (P.O. Box 69) 80100 Joensuu	973-25 211
Vaasa	Kauppapuistikko 15 (P.O. Box 262) 65100 Vaasa	961-122 555
Central Finland	Vapaudenkatu 55 (P.O. Box 110) 40100 Jyväskylä	941-215 511
Kokkola	Torikatu 40 B 67100 Kokkola	968-19 555
Oulu	Mäkelininkatu 37 (P.O. Box 124) 90100 Oulu	981-15 041
Kainuu	Kalliokatu 4 (P.O. Box 115) 87100 Kajaani	986-1631
Lapland	Hallituskatu 3 96100 Rovaniemi	960-2941

ADDITIONAL INFORMATION ABOUT THE WATER AND ENVIRONMENT ADMINISTRATION

Further information can be obtained from:

National Board of Waters and Environment

(Vesi- ja ympäristöhallitus)

Pohjoinen Rautatiekatu 21 B

00100 HELSINKI

Tel. 358-0-40281 (international); 90-40281 (national)

Telefax 90-4028 345



WATER AND ENVIRONMENT ADMINISTRATION IN FINLAND

CONSTRUCTION, OPERATION AND MAINTENANCE ACTIVITIES

The following construction, operation and maintenance tasks are carried out on behalf of the State:

- implementation of flood control and drainage projects
- implementation of projects serving recreational use of waters, water pollution control, fisheries and conservation of the aquatic environment
- implementation of projects serving boating
- construction of regionally important feed pipes and connecting pipelines for water supply as well as sewers to remove wastewater discharge to less vulnerable recipients
- construction of ponds for providing natural nutrition to fish, and participation in the construction of fish farms and hatcheries
- participation in the preparation of peat extraction sites
- implementation of projects serving waste management
- maintenance of hydraulic engineering structures placed in the charge of the State
- implementation of the obligations concerning fisheries etc, included in Water Court permits
- regulation of certain major watercourses, monitoring and controlling of hydrological aspects in these watercourses, and preparation of forecasts and operation rules
- combatting of ice jams and sudden floods
- oil damage prevention
- supervision and control of dam safety
- supervision and control of the maintenance of drainage works
- maintenance of public water areas

THE INSPECTION PROCEDURE IN LICENSING

Applications for permits, addressed to the Water Court, are handled either by public announcement or by applying the inspection procedure. The purpose of the inspection procedure is to prepare the Water Court's decision and to assess all the benefits and adverse effects of the project. The civil servants appointed to carry out the inspection procedure, although they are employees of the National Board of Waters and Environment, act in this task independently.

DATA SYSTEMS

The data systems of the Water and Environment Administration, together with those of the Ministry of the Environment, form the so called environmental information system. The environmental information system will be developed into a comprehensive data collection, processing and output system serving all sectors involved in environmental management, monitoring and research.

FINANCING ACTIVITIES

The Water and Environment Administration directs State subsidies for the promotion of water supply and water pollution control. Grants and reduced-interest loans may be granted for communal water supply and sewerage and wastewater treatment. Small water supply and sewerage projects are subsidized with special loans granted on the basis of the farmstead legislation. Reduced-interest loans are granted for water pollution control measures in industry. Nowadays it is also possible to acquire grants for water pollution control measures at farms.

Allocation of funds for various sectors in 1986

Sector	Million FIM	
Economics and administration	57	1
Planning and coordination	53	1
Supervision	16	
Licensing inspections	7	
Research	41	1
Construction	148	3
Operation and maintenance	16	
Investments	77	1
Total	415	10

PUBLICATIONS AND DISSEMINATION OF INFORMATION

The results of studies, research and monitoring are published in the publication series of the National Board of Waters and Environment, in annual reports and bulletins, and in scientific journals. The aim is to disseminate information about decisions made, plans and initiatives taken as soon as possible to the parties concerned.

WATER AND ENVIRONMENT ADMINISTRATION

The task of the Water and Environment Administration is to promote the use, management and protection of waters and to combat damage caused by water, for example by floods, and to promote research on waters and other sectors of the environment.

The Water and Environment Administration is subordinated to the Ministry of the Environment. However, the Ministry of Agriculture and Forestry directs the management of matters related to water supply and sewerage, flood control, drainage and land reclamation.

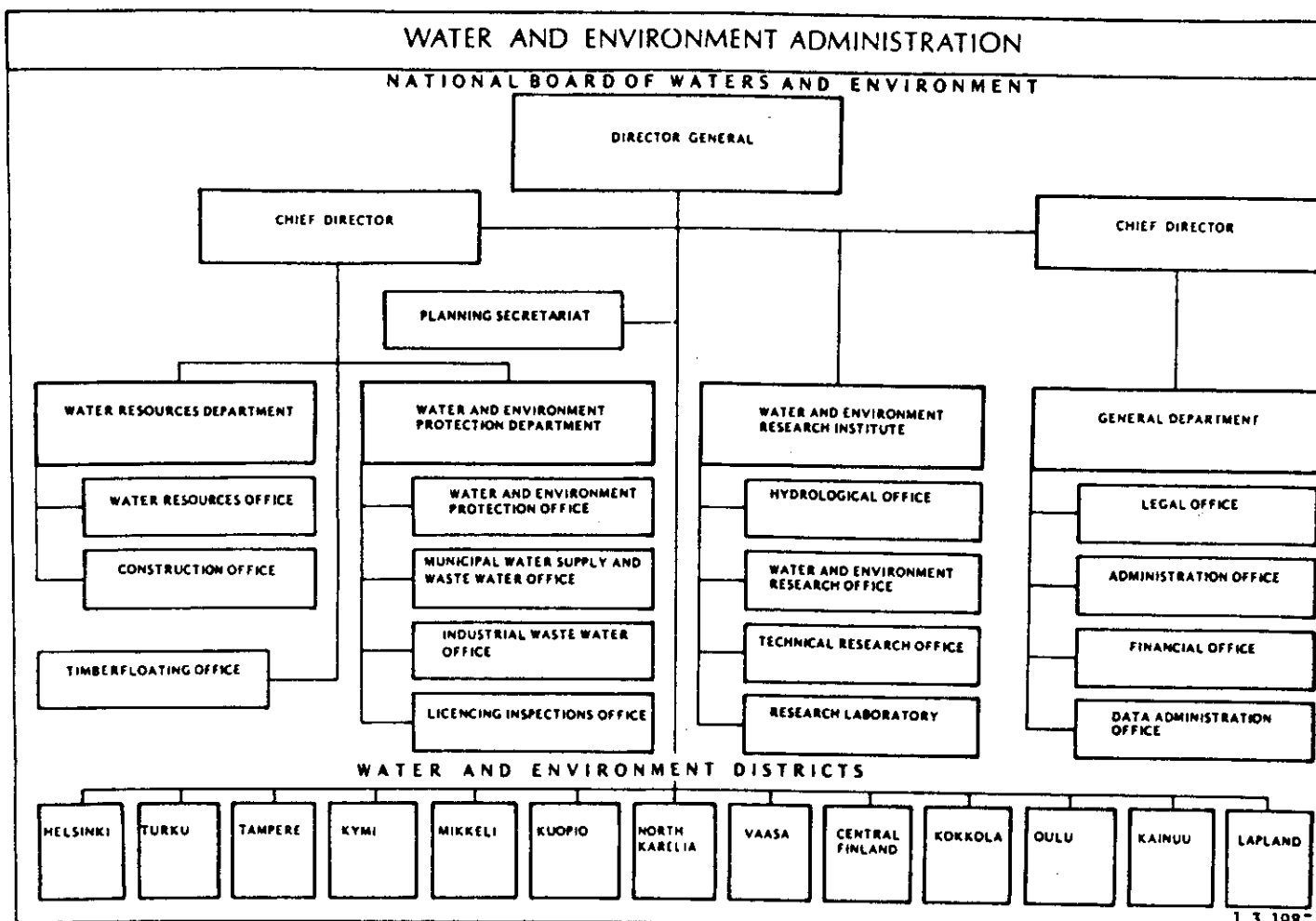
The Water and Environment Administration, formerly the Water Administration, started operations on 1 October 1986. The Water and Environment Administration consists of the National Board of Waters and Environment and its 13 Water and Environment Districts. It employs a staff of about 1500, of which some 400 work at the central agency and about 1100 in the Water and Environment Districts.

FINLAND'S WATER RESOURCES AND ENVIRONMENT

About 9,7 % of Finland's area is covered by lakes. The mean annual precipitation is about 670 mm, half of which evaporates and half flows into the sea through the watercourses. Some 10 % infiltrates into the ground as groundwater. There are about 56 000 lakes in Finland with a surface area of 1 hectare or more. The total volume is 235 km³. Inflow to the sea via the watercourses is about 110 km³ annually. The theoretical turnover time of water in the lakes is two years.

Most of the Finnish lakes are in a natural or near-natural state and are oligotrophic. About 2 % of the lake area is badly polluted and 18 % is slightly contaminated. The pollution of waters has to a great extent been curbed by the water pollution control measures started in the 1970's.

Finland's topography is generally even and low. Of the land area about 60 % is forest and 30 % bogs. The proportion of cultivated



land is about 8 % and that of built-up areas somewhat over 2 %. The mean elevation above sea level is about 150 m. About 3 % of the land area is exposed bedrock. The layer of loose soil covering the bedrock is relatively thin in general less than 10 metres, but in places it may be as thick as 100 metres. The most important aquifers are found in glacial sand and gravel formations. Groundwater resources suitable for use are replenished at a rate of 60–80 m³/ sec. The share of groundwater in public water supply increases constantly, being at present about 50 %.

WHAT ARE THE TASKS OF THE WATER AND ENVIRONMENT ADMINISTRATION

The tasks of the Water and Environment Administration are:

- to promote the reconciliation of the objectives and needs related to water use, management and protection
- to supervise water protection and prevention of oil damage
- to participate in tasks related to waste management and other aspects of environmental protection
- to develop water supply and sewerage
- to supervise flood control, drainage and land reclamation
- to ensure dam safety
- to supervise and maintain public water areas
- to promote the use of waters for recreational purposes
- to carry out the inspections and studies needed for licensing
- to draw up plans concerning use, management and protection of waters
- to promote and carry out environmental research and monitoring of the state of the environment
- to control and supervise the watercourses and their use as well as the activities influencing watercourse quality
- to maintain and develop information systems related to waters and environmental protection
- to carry out construction, maintenance and operation tasks on behalf of the State in this sector
- to carry out special tasks delegated by the ministries related to fisheries and other interests

The Water and Environment Districts supervise these tasks in their respective regions. Within the districts, responsibilities are divided according to fields of activity, i.e. planning, construction, water and environment protection, research and administration. The National Board of Waters and Environment has the role of an expert agency which also guides, harmonizes and supervises the activities of its Water and Environment Districts.

PLANNING ACTIVITIES

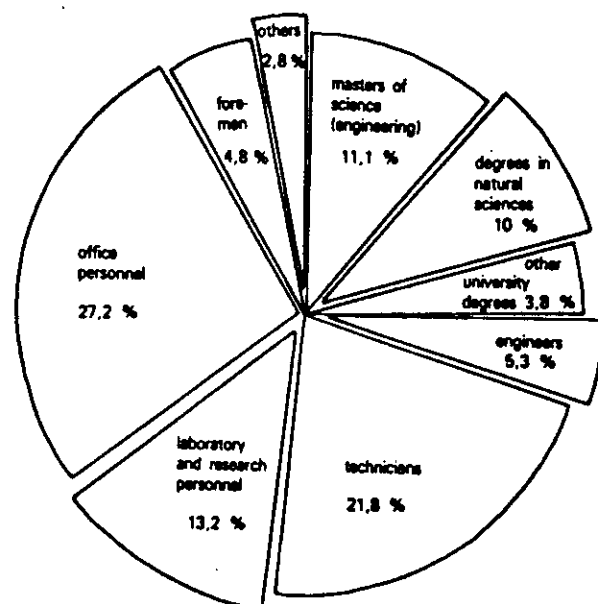
The Water and Environment Administration draws up plans for water use, management and protection at national and regional levels and at the level of individual projects. At the national and regional levels the planning work has a guiding and reconciling character. The project plans are detailed plans, on the basis of which the Water and Environment Administration carries out measures involving water bodies or water areas.

A plan may cover one or several of the following tasks:

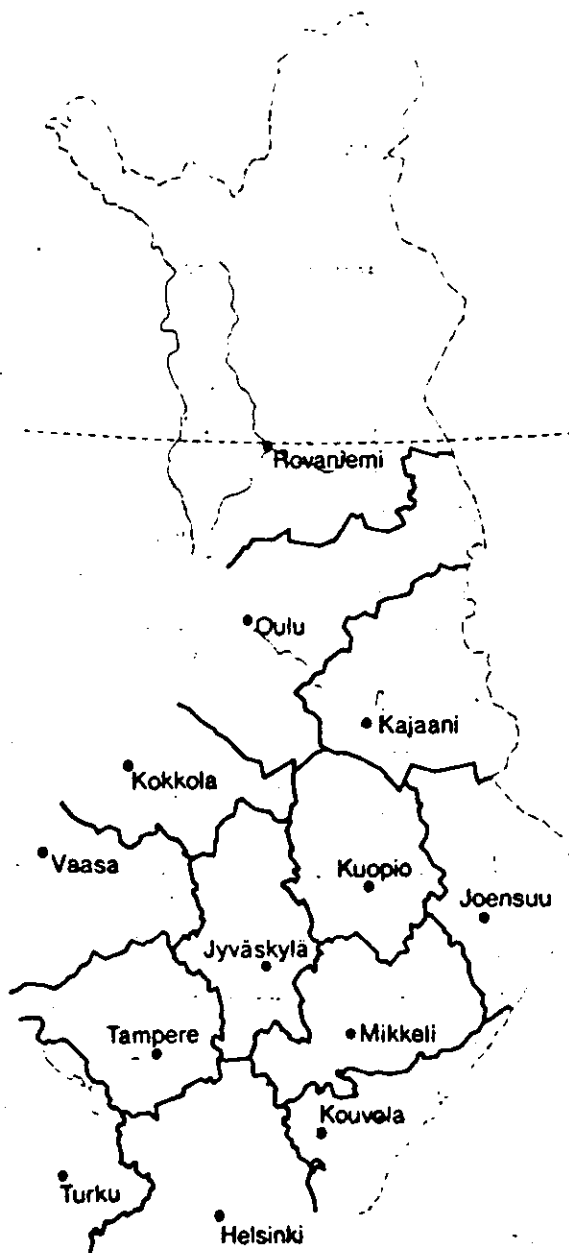
- water supply and sewerage
- water protection (related to point- and non-point source pollution, as well as impacts of construction and engineering works)
- recreational use of waters
- restoration of water bodies and care and management of waterscape
- flood prevention and control
- fisheries
- land drainage
- preparatory work at peat extraction sites (access roads, drainage and sedimentation basins)
- waste management

The Water and Environment Administration carries out its planning work in cooperation with other authorities, bodies and local people.

The personnel of the Water and Environment Administration 30 December 1986



BOUNDARIES AND HEADQUARTERS OF THE WATER AND ENVIRONMENT DISTRICTS



Helsinki 1988. Government Printing Centre

SUPERVISION ACTIVITIES

As a public supervisory authority the duty of the Water and Environment Administration is to ensure that the Water Act and the decisions based thereon are complied with. The Water Act contains three bans which may not be violated without a permit issued by the Water Court. The bans concern:

- impeding (passage)
- altering (flow, water level)
- polluting

In its capacity of the representative of public interest the Water and Environment Administration appears in courts of justice when matters related to waters are debated. The majority of court decisions concern permits which include conditions dealing e.g. with deadlines, monitoring of impacts in the aquatic environment, levels of effluent treatment, or limits for water level elevations. The staff members of the Water and Environment Districts annually implement thousands of supervisory calls at different sites. The Water and Environment Administration also participates in the supervision of waste management, although this task belongs primarily to the provincial administration.

RESEARCH ACTIVITIES

The Water and Environment Administration monitors changes in water quantity and quality and carries out investigations and research, primarily for the needs of its own administrative branch but also for external bodies that may need this information.

The objective of hydrological research is to acquire basic data on Finland's water resources by making observations concerning the hydrological cycle and the characteristics of and phenomena related to water bodies. This requires extensive monitoring of e.g. precipitation, evaporation, water level elevations, flows, runoff, groundwater quantity, groundfrost, water temperature and ice phenomena.

One objective of the research work is to gain knowledge on the state, and changes in the state, of inland water bodies and the surrounding sea areas. Long-term monitoring of a variety of parameters is one means to attain this end. Current items of research are eutrophication of water bodies, wash-out of nutrients, acidification and occurrence of toxic substances.

Technical research includes the development of methods used in water supply and water pollution control. In addition, soil investigations are carried out and the impacts of earthworks and hydraulic engineering on surface water and groundwater are studied. The volume of research serving waste management has increased significantly in recent years.

The National Board of Waters and Environment and its Water and Environment Districts have laboratories in which water samples are analyzed and research methods are developed.

APPENDIX III
ICE CLEANER

Ice Cleaner

Full Scale Tests with Oil

ATTENDANCE LIST

Mr. Seppo Korppoo	Oy LORI Ab
Mr. Lars Lundin	Oy LORI Ab
Mr. Tage Lindfors	Oy LORI Ab
Mr. & Mrs. Bert Hartley	Hartec, Anchorage, Alaska
Mr. & Mrs. Bill Stillings	Cook Inlet Response Organization, Nikiski, Alaska
Mr. Frank McCorcle	Cook Inlet Response Organization, Nikiski, Alaska
Mr. Burle Wescott	Cook Inlet Response Organization, Nikiski, Alaska
Mr. Steve Bowen	Alaska Clean Seas, Anchorage, Alaska
Mr. Walter Spring	Mobil Oil, Dallas, Texas
Mr. Phil Larsen	VECO, Anchorage, Alaska
Mr. Rocky Luman	VECO, Anchorage, Alaska
Mr. Bruce Banks	Jamestown Marine, Rhode Island
Mr. Jim Bladh	US Navy, Antarctica Project, Washington D.C.
Mr. Hugh Brown	Esso Resources, Calgary, Alberta
Mr. John Latour	Canadian Coast Guard
Mr. Todd Mitchell	Navenco, Montreal, Quebec
Mr. Thomas P. Mackey	Hyde Products Inc, Cleveland, Ohio
Mr. Dan Neely	Hyde Products Inc, Hilton Head, South Carolina
Mr. Atle Nordvik	Norsk Oljevernforening For Operatørselskap
Mr. Rick Auger	Norsk Oljevernforening For Operatørselskap
Mr. Widar Skogly	Norsk Oljevernforening For Operatørselskap
Mr. Birger Nordberg	Saga Petroleum
Mr. Haldor Haldorsen	Statoil
Mr. Hans Jensen	Norwegian Hydrotechnical Laboratory, Trondheim

Continues...



LORI ICE CLEANER

Company: LORI Oy Lundin Oil Recovery Inc. Ab
Karvaamokuja 4, 00380 Helsinki
Tel: + 358 0 506 1800
Fax: + 358 0 506 2110
Country: Finland
Presenter: Seppo Korppoo

GENERAL DESCRIPTION OF LIC

LIC Lori Ice Cleaner can be fitted to various types and sizes of vessels in order to enable them to serve as oil recovery units in ice conditions. The LIC self contained unit is attached to the bow of a vessel.

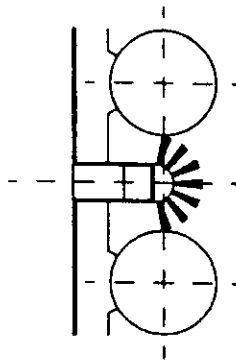
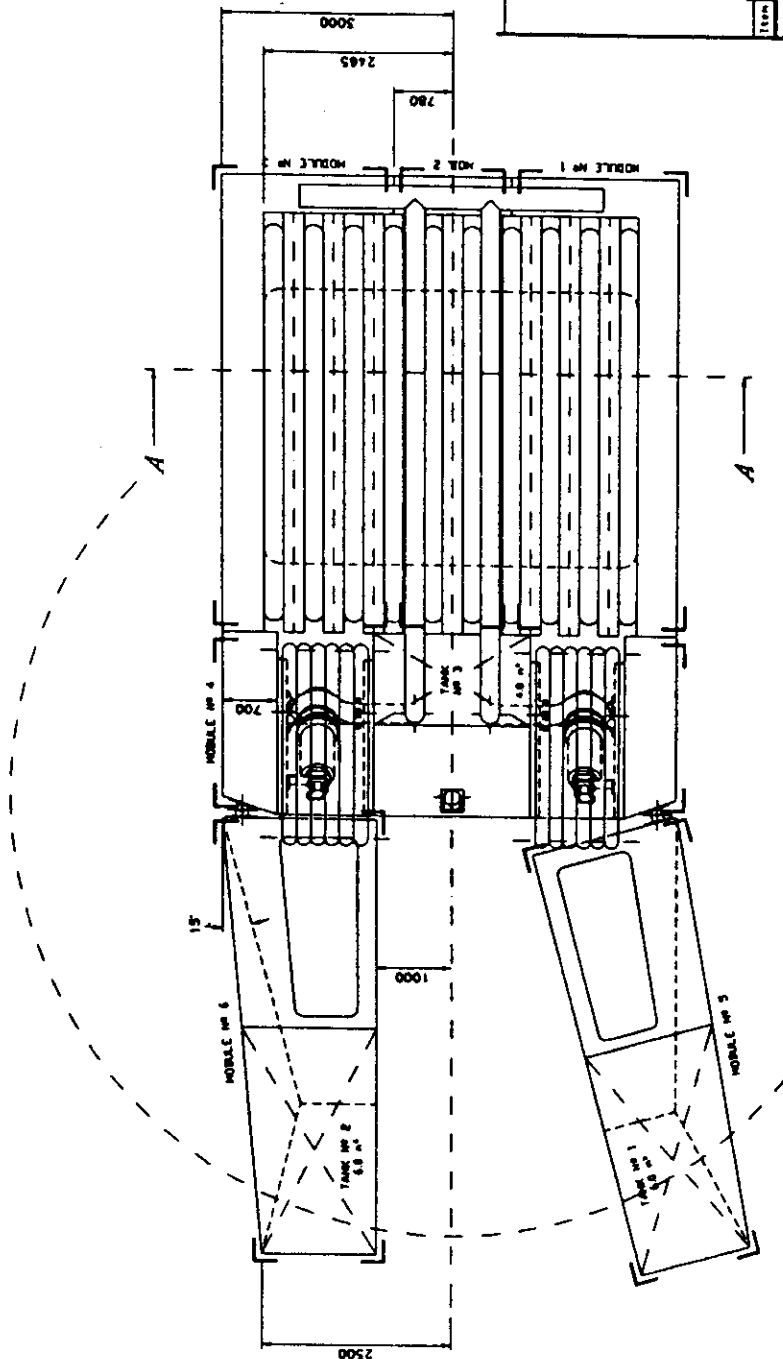
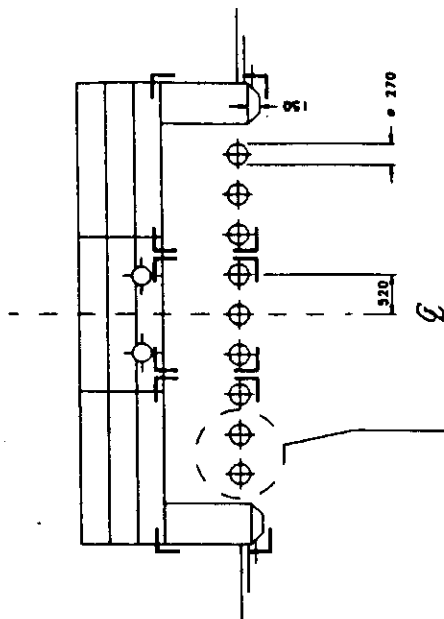
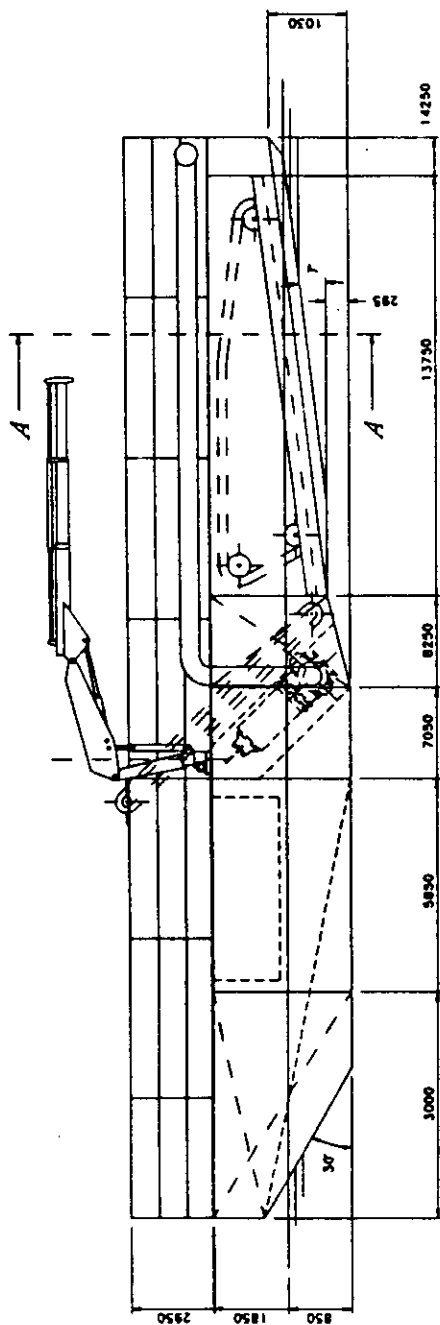
LIC is primarily designed to operate in broken ice at sea, lakes, rivers and ports. If the oil spill area is made up of ice thicker than 20 cm or larger than 2 x 2 meter ice floes, the recovery area should be broken up by another vessel before the beginning of the recovery operation. LIC can recover most types of oil and debris in various environmental conditions. LIC recovery process is carried out by a full scale tested, patented two stage brushing and water pumping system.

LIC is designed to be a removable unit attached to the bow of a vessel. The lashing system allows several different vessel bow configurations to be used, allowing flexibility in choosing the pushing vessel. The recommended vessel is a tug boat which is 20-40 meters long and 5-10 meters wide.

LIC is constructed of six unpainted marine grade aluminum modules to allow for flexible storage and transportation via land, air or sea. The modules are bolted together and attached to the pushing vessel by a special lashing system. The largest of the modules is designed according to the dimensions of a standard twenty foot container (6.048 m x 2.438 m x 2.438 m).

A mobile air cooled power module, including a diesel engine, generator, hydraulic pump, fuel tank, hydraulic oil tank, hoses and electric cables, is placed on the deck of the pushing vessel in order to give high autonomy to the LIC unit.

A-A



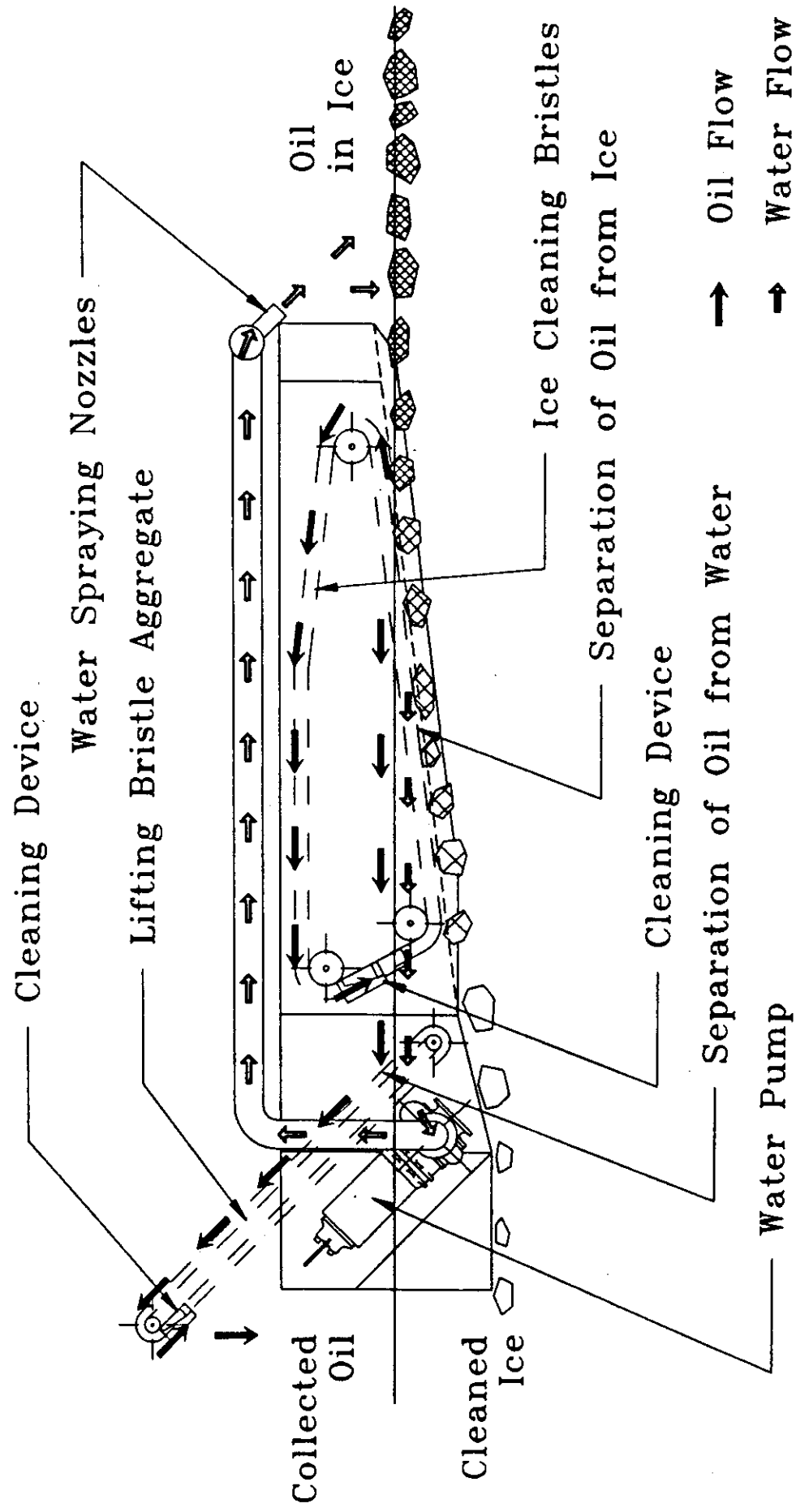
Dimensions:

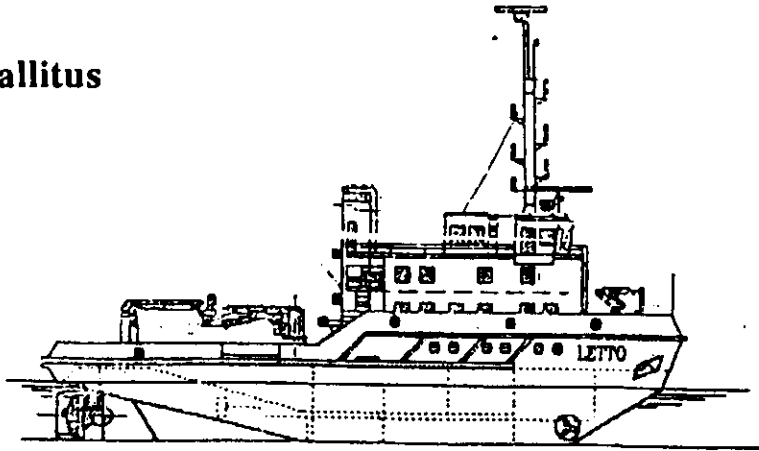
Length, o.a.	14.25 m
Breath, moulded	6.00 m
Depth to main deck	1.85 m
Operational Draught in fresh water	0.85 m
Displacement	abt. 25.10 t

Item	Description	No	Size	Material	Drawing No	Remarks
					Scale 1:50	Vt.
					Reference	
					Date	19/3-1990
					Drawn	TL
					Checked	
					2.026.1112.01.001 B	
					Ice Cleaner	
					General Arrangement	
					2.026.1112.01.001 B	
					By Landa On	
					Recovery Inc. AS	

LORI

Flow scheme of oil, ice and water





Västervik LETTO

Kapteenin määräykset Captain's instructions

**LORI ICE CLEANER FULL SCALE kokeiden aikana.
During LORI ICE CLEANER FULL SCALE tests.**

Tupakointi

- kielletty kaikilla avokansialueilla klo 10:00...16:00
- sallittu sisätiloissa ikkunaventtiilien ollessa suljettuina

Smoking

- NOT permitted in open deck areas between 10:00...16:00
- PERMITTED inside if all windows are closed

Pääsy kielletty

- konevalvontakeskukseen
- konehuoneeseen
- lastihydrauliikkaruumaan

No entrance

- machinery control room
- engine room
- hold containing deck machinery hydraulics

Västervik Leton päällikkö



Pekka Ellilä, Merikapteeni

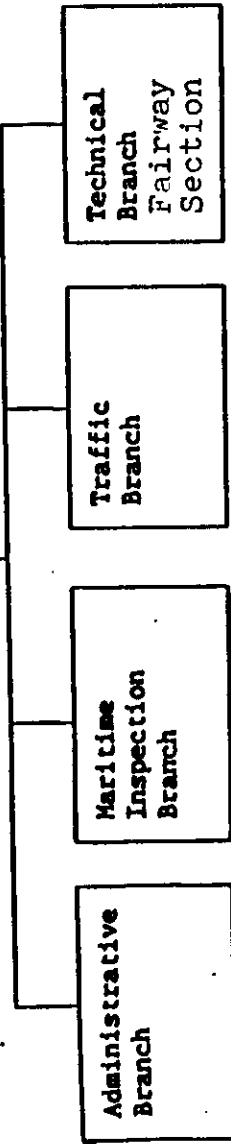
DISTRICT ORGANIZATION

MARITIME DISTRICT *)

GULF OF BOTHNIA DISTRICT

Head of Maritime District

SEA CAPTAIN
VOITTO HOSKIO



SEA CAPTAIN
VELI JUUVINEN

fairway maintenance CO-ORDINATIVE CAPTAIN
SEA CAPTAIN PEKKA ELLI
oil combatting vessels

supply vessels
pilot boats

*) Maritime Districts

Gulf of Finland District
Southwestern District
Gulf of Bothnia District
Inland Waterways District

District office

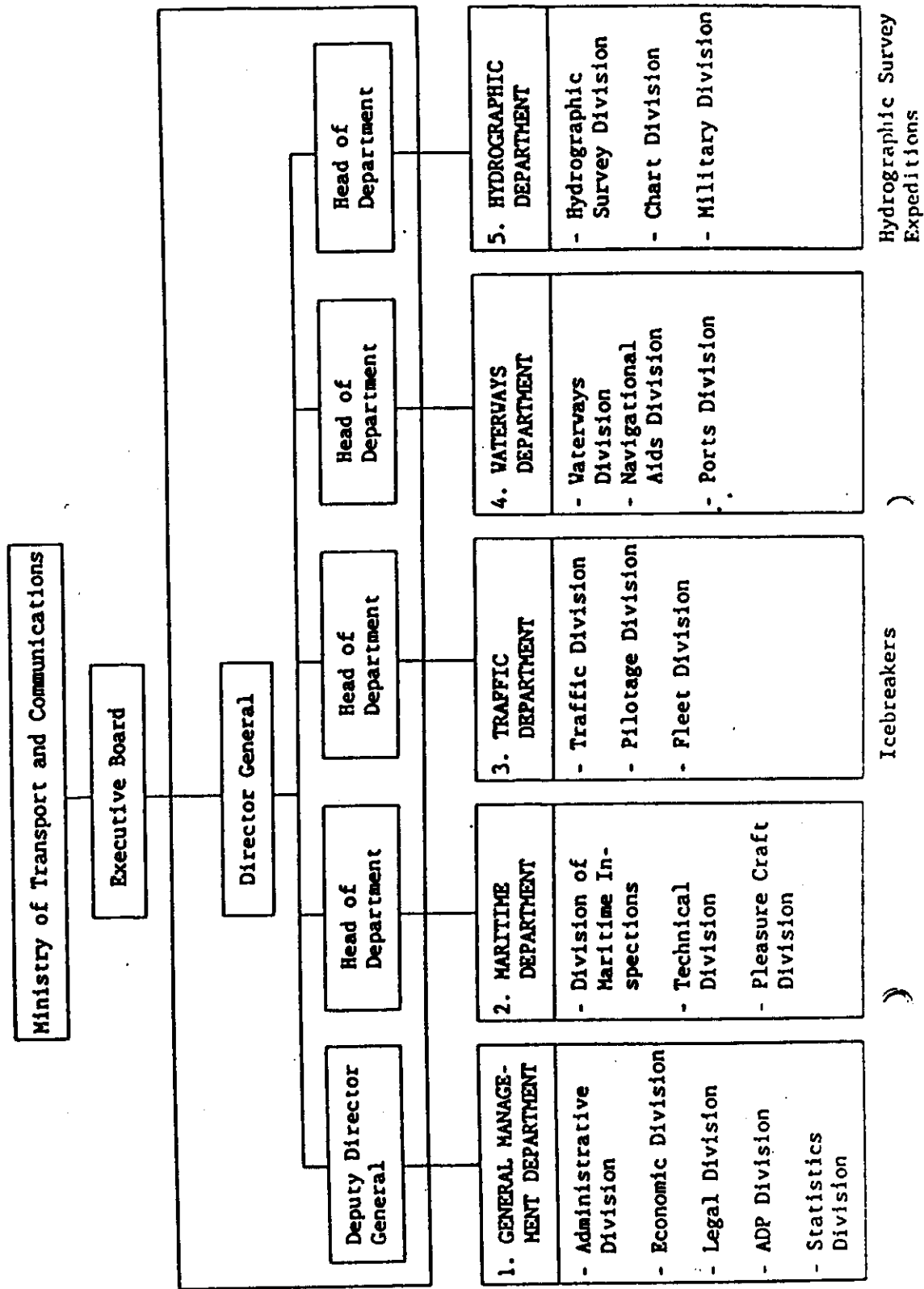
Helsinki
Turku
Vaasa
Lappeenranta

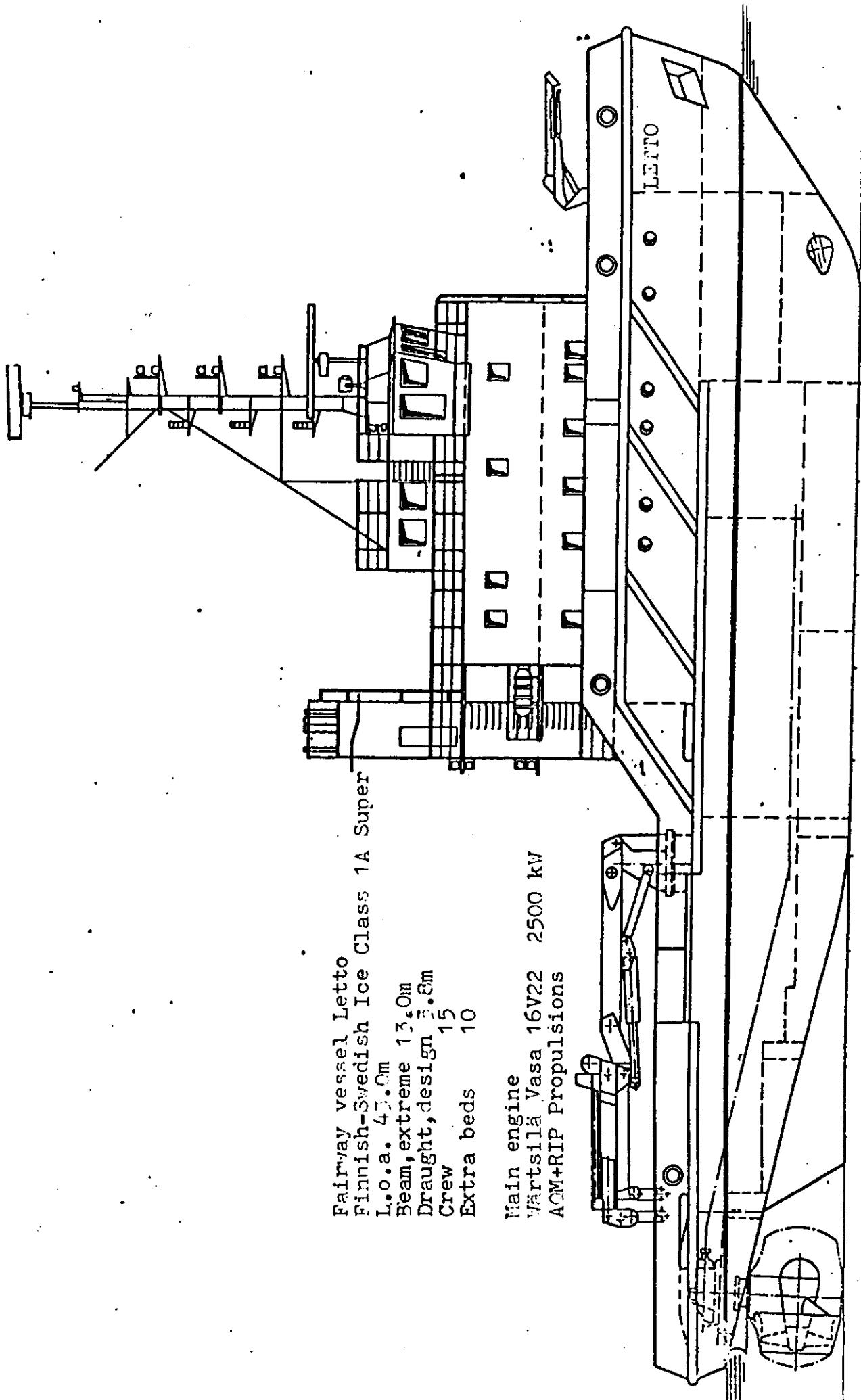
Sub office

Kotka
Maarianhamina
Oulu
Savonlinna, Joensuu, Kuopio,
Jyväskylä, Tampere

NATIONAL BOARD OF NAVIGATION

ORGANIZATION





Fairway vessel Letto
Finnish-Swedish Ice Class 1A Super
L.O.a. 43.0m
Beam, extreme 13.0m
Draught, design 5.8m
Crew 15
Extra beds 10

Main engine
Wartsilä Vasa 16V22 2500 kW
ACM+RIP Propulsions